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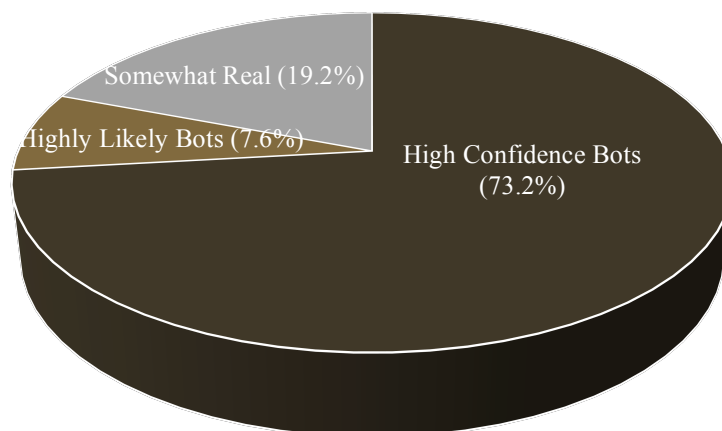
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Report Date: May 18, 2020	Industry: Fraud (nominally education)
Company: GSX Techedu Inc.	Stock Price: \$35.43
Ticker: GSX US	Market Cap: \$8.5 billion
	Float: 24.9%
	Average Daily Volume (30-day): \$194.6 million

GSX Techedu: Rise of the Machines

GSX Bot Prevalence



- We are short GSX because we conclude that it is a near-total fraud.
- We conclude that at least ~70% of its users are fake, and we think it's quite likely that at least ~80% of its users are fake.
- Our conclusions are based on GSX's own user and attendance data files (i.e., this is not from "scraping" data). We downloaded GSX's data from more than 200 paid K-12 classes covering 54,065 unique users.
- In addition, a former GSX manager corroborated our analysis, and explained various details of GSX's extensive bot operation.

- Based on the near total faking of users, we assume that the fraudulent portion of GSX’s revenue is at least equal to the percentage of fraudulent users, although it would not surprise us if the ASP on the real portion of GSX’s business is fraudulently inflated too.
- We conclude that GSX is a massive loss-making business. Without users, there is no revenue. We also conclude that GSX greatly understates expenses. Regardless of how one cuts it though, GSX is an almost completely empty box.
- Amazingly, Chairman Chen has found a way to make GSX shares even more dangerous for long holders – he has pledged at least \$318 million of stock. Long holders of GSX face the risk that the margin lenders will be forced to aggressively sell the stock, crashing the price.

We are highly confident that at least 73.2% of the 54,065 users in the analyzed classes are bots. We identified these bots through patterns we call “Precise Joiners”, “GSX IP Joiners”, and “Burst Joiners”. However, we think it is quite likely that at least 80.8% of the users are bots. We reach this ratio when we include users displaying an anomalous behavior we call “Early Joiners”. Moreover, we reached these conclusions using assumptions we believe are company favorable. A somewhat less company-favorable approach would yield a fake user ratio approaching 90%.

Chairman Chen strangely tried to dissuade us from looking at GSX last month. In an interview with Chinese media on April 8th, he said

“I think if Muddy Waters analyzes our data seriously, there is a high probability that I think Muddy Waters will not be so stupid. The level and IQ of the people in Muddy Waters is quite high.”¹

That was obviously a bluff, and we call it.

Bot Hunting and Identification

We analyzed 463,217 sign-on records for 54,065 Genshuixue and Gaotu users across more than 200 paid K-12 classes in the first half of 2020. We identified three bot patterns that we are highly confident accounted for 73.2% of the unique users in our study. Adding a fourth pattern, which we think highly likely indicates bots, brings the bot proportion to 80.8%. Changing certain assumptions to be less company-favorable would bring the bot total to approximately 90%. The fake users are apparently controlled by GSX teachers and tutors, as well as by third parties.

¹ <https://finance.sina.cn/stock/relnews/us/2020-04-10/detail-iircuyvh6962383.d.html?from=wap>, “我觉得浑水他要是认真分析我们的数据的话，大概率我觉得浑水不会那么愚蠢，浑水那帮人的水平和智商还是蛮高的。”

The records are available to any paying student and can be legally accessed through Google Chrome, an iPhone, and a proxy server.² We provide detailed instructions on how to access these records in Appendix 1.

There are four patterns of user joining that we believe show the user is actually a bot. A former GSX manager corroborated our observations and provided further detail on how GSX carries out its user fraud. We term these four patterns of bot users: Precise Joiners, Burst Joiners, GSX IP Joiners, and Early Joiners.

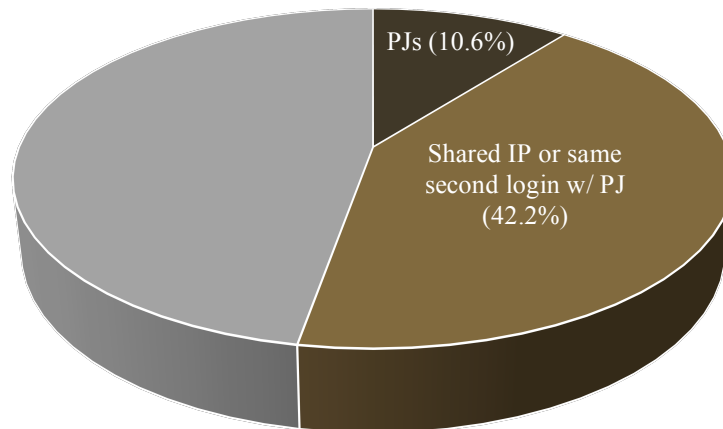
² The archives are in a zip file. The file format is GZIP-compressed TAR archive (.tar.gz) otherwise known as a tarball.

Precise Joiners

Over half (52.8%) of the unique users in our sample were identified as bots because they are “Precise Joiners” or are linked to them. Precise Joiners are users who join a class at same time – to the second – on the same day of at least two different weeks, and the users linked to them. We contend that the probability of such a precise login happening two or more times for single user in a single course is extremely low. In addition to variability on a (human) user’s side in terms of when he logs in, there are moment-to-moment differences in the way internet traffic and data within GSX’s own network is flowing that make logging in at the precise second one or more weeks apart almost impossible. To us, that is similar to a weekly flight from City A to City B touching down two or more times at exactly the same second.

Within the data of the 54,065 unique users analyzed we found 5,742 users (10.6%) whose logins record this precise joining phenomenon. Note also that 100% of these Precise Joiners exhibited at least one of the other bot behaviors we discuss, which resoundingly validates this method of bot hunting.

Precise Joiner Bots (% of 54,065 Unique Users)



While most Precise Joiners recorded only one precise join (two different occasions with log-ins at the same second), our data found 1,261 (21.6%) of the unique Precise Joiners performed this feat on two or more occasions, and one Precise Joiner recorded nine Precise Joins.

Frequency of Precise Joins by User									
Frequency	All Types			"Students"			"Tutors"		
	Total All Types	% Total Uniques	% of Precise Joiners	Total Type 0	% Total Uniques	% of Precise Joiners	Total Type 2	% Total Uniques	% of Precise Joiners
Users with 1 Precise Join	4,584	8.479%	78.55%	4,518	8.357%	77.42%	66	0.12%	1.13%
Users with 2 Precise Joins	493	0.912%	8.45%	481	0.890%	8.24%	12	0.02%	0.21%
Users with 3 Precise Joins	543	1.004%	9.30%	529	0.978%	9.06%	14	0.03%	0.24%
Users with 4 Precise Joins	106	0.196%	1.82%	105	0.194%	1.80%	1	0.00%	0.02%
Users with 5 Precise Joins	69	0.128%	1.18%	69	0.128%	1.18%	0	0.00%	0.00%
Users with 6 Precise Joins	25	0.046%	0.43%	25	0.046%	0.43%	0	0.00%	0.00%
Users with 7 Precise Joins	12	0.022%	0.21%	12	0.022%	0.21%	0	0.00%	0.00%
Users with 8 Precise Joins	3	0.006%	0.05%	2	0.004%	0.03%	1	0.00%	0.02%
Users with 9 Precise Joins	1	0.002%	0.02%	1	0.002%	0.02%	0	0.00%	0.00%
Sub-total	5,836	10.794%	100%	5,742	10.621%	98.4%	94	0.174%	1.6%

We then linked these Precise Joiners to 33,145 additional users who share the same distinct IP and users who joined classes at the exact same moment (often as part of large bursts).³ After subtracting 10,342 duplicates, this resulted in 28,545 total users (52.8%) that we are highly confident are fake.

Sum of "Student/Bot" Precise Joiners & Linked Users						
	Total	% of Total Uniques	Total Joins	% of Total Joins	Total IPs	% of Total IP Address
Precise Joiner, Student	5,742	10.6%	95,988	20.72%	27,001	16.35%
Joined at same precise second as another Precise Joiner	27,992	51.8%	318,861	68.84%	105,586	63.95%
Shared a distinct IP address with another Precise Joiner	5,153	9.5%	75,116	16.22%	27,414	16.60%
Total Unique Precise Joiner-Linked Users (sum of 3 lines above less overlapping data points)	28,545	52.8%	325,711	70.3%	107,045	64.8%

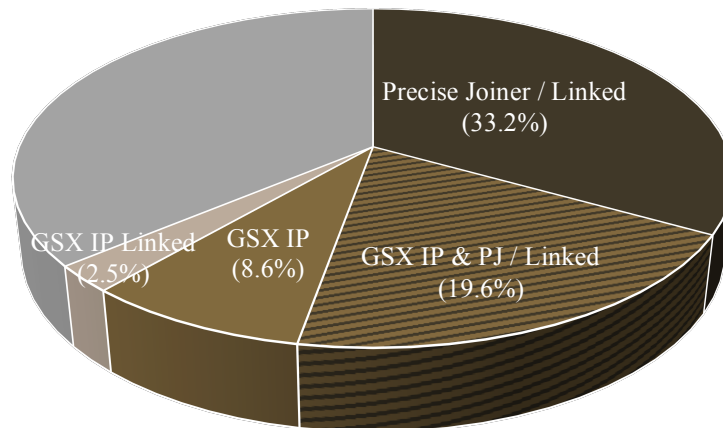
³ The same moment in time means at precisely the same second, same day, two or more different weeks.

GSX IP Joiners

Adding GSX IP Joiners brings the total percentage of High Confidence bot users to 34,534 users, or 63.9%. GSX IP Joiners are unique purported student users that use the same IP address as a teacher or student, or are linked to such users. Because GSX no longer operates physical schools or learning centers, it should not be possible for students to share the IP of a teacher or tutor. Yet 15,239 purported student users (28.2%) shared a teacher or tutor IP on at least one occasion. The former GSX manager confirmed that some teachers and tutors operate bot networks for GSX. Almost two-thirds of GSX IP Joiners are also Precise Joiners, which reinforces our conclusions.

Another 1,364 unique users are linked to these GSX IP Joiners, bringing the total percentage of unique users identified this way to 16,603, which is 30.7%.⁴ The 1,364 additional users link to the 15,239 purported student users through shared IPs.

GSX IP Bots (% of 54,065)



"Student" Users Linked to GSX Teacher & Tutor IPs						
User Description	Total	% of Total Uniques	Total Joins	% of Total Joins	Total Distinct IPs	% of Total Distinct IPs
Unique Teachers & Tutors*	394	0.73%	7,700	1.66%	743	0.5%
Unique users sharing a distinct IP with a Teacher / Tutor ("Student")	15,239	28.19%	182,344	39.36%	24,016	14.5%
Unique users shairing a distinct IP with a "Student/Bot"	1,364	2.52%	13,484	2.91%	28,817	17.5%
Total unique GSX-linked "Student/Bot" users*	16,603	30.71%	195,828	42.28%	47,583	28.8%

*Elimates overlapping data points for IP addresses and teachers/tutor counts.

There were 10,614 GSX IP Joiners (63.9%) that were also Precise Joiners. Eliminating the duplicate unique users, our High Confidence bot total reaches 63.9%.

⁴ Some of the GSX IP Joiner bots also logged in from non-teacher / tutor IPs (the average IP to GSX IP Joiner ratio is 2.9:1). We noted 47,583 different IP addresses across these 16,603 unique users. The 394 teacher and tutor accounts to which these bots link logged into the classes we studied using 743 IP addresses, which is a ratio of 1.9:1, showing yet another suspicious metric with respect to the GSX IP Joiners.

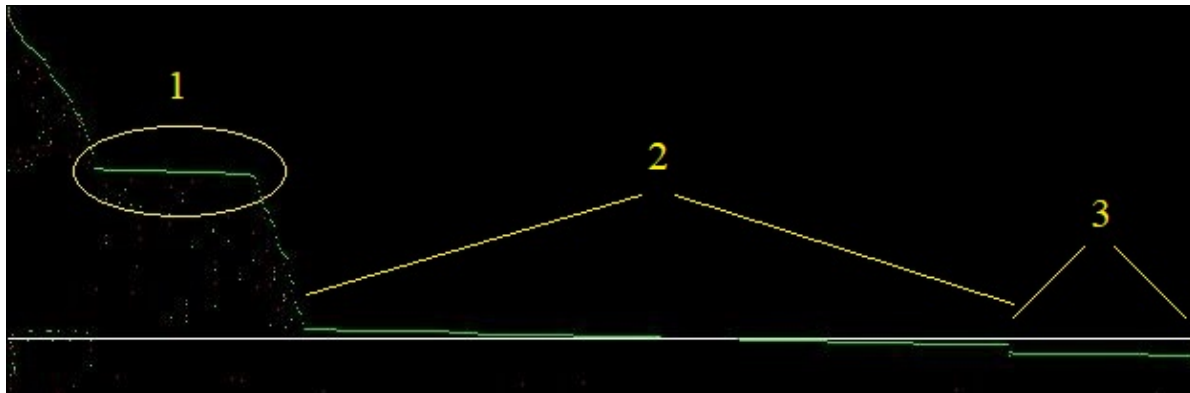
Sum of "Student" Precise Joiners & Linked Users						
Unique Users When Combining Precise Joiners, Precise-Joiner Linked Users & GSX-Linked "Student/Bot" Users	Total	% of Total Uniques	Total Joins	% of Total Joins	Total IPs	% of Total IP Address
		34,534	63.9%	359,690	77.7%	112,281

Burst Joiners

We count 5,016 additional bots from Burst Joiners, bringing the High Confidence total to 39,550, which is 73.2%. Burst Joiners are large groups of users who join at the same second (4,528 / 8.4%), e.g. 20 or 30 users in the same second, and other users that link to them through shared IPs (488 / 0.9%). What makes this phenomenon even more conspicuous is that these bursts often take place in the midst of little – to no – joining activity. This anomaly strikes us as similar to seeing 10 subway trains pass by in an hour, with nine of them completely empty and one completely full. Real life just does not work this way.

Reinforcing our conclusions, 62.8% of Burst Joiners display at least one other High Confidence bot behavior. We are highly confident that when these bursts occur more than five minutes before or after the start of a class, it means a group of bots has been suddenly logged into the class. We believe the five-minute cut-off is company favorable, and that the real number of bots that are burst joining within the excluded window could be significant.

The Burst Joiner pattern for a given class can be visualized by a graph on which the Y axis is time, broken into increments of one second, and the X axis is each unique user. When burst joins occur, this graph displays long horizontal lines. The graph below shows the joining pattern for a class for a paid upper grade elementary school math course on the GSX platform that runs over several months. The below pattern is generally consistent with the classes in our data set – i.e., it is fairly typical. (Note the horizontal white line is the second at which the class started.)



In Burst 1, 104 unique users join during a four second period that begins nine minutes 40 seconds before the start of class. There are six Precise Joiners in Burst 1.

To be company favorable, we do not count bursts that occur five minutes before class start through five minutes after class starts. Therefore, although they are greatly suspect, we do not count logins in Burst 2 as bots, unless they exhibit some other bot behavior (including joining at

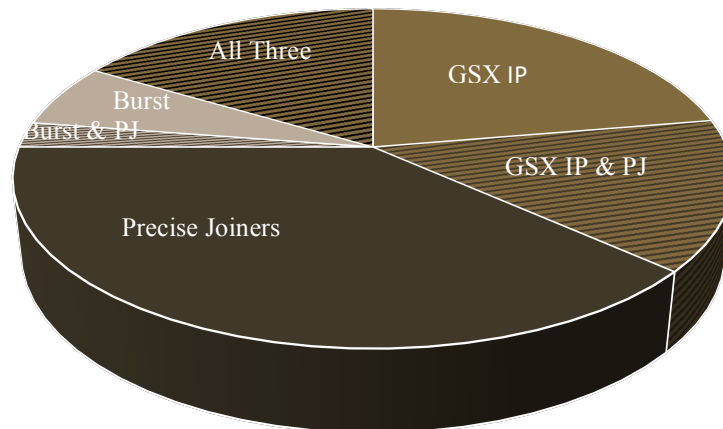
the same second as a Precise Joiner). In the nine second period starting from five seconds before the start of class to three seconds after class starts, 648 users – including 37 Precise Joiners – joined. We therefore did not count about two-thirds of these logins as bots because they did not join in the same second as Precise Joiners.

Although Burst 3 occurs at four minutes seven seconds after class starts (within the five minute window), we count these joiners as bots because during this three second window, among the 96 stragglers were three Precise Joiners that joined at the same times.

Overall High Confidence Bot Mix

There is significant overlap among the various bot use patterns we observed. On a standalone basis, we are highly confident that each behavior indicates bots. However, when we see the overlaps between the various behaviors, the patterns are even more solidly established as indicia. One-third of the High Confidence bots exhibited at least two indicia of bot behavior. Approximately one-half of that number exhibited all three indicia.

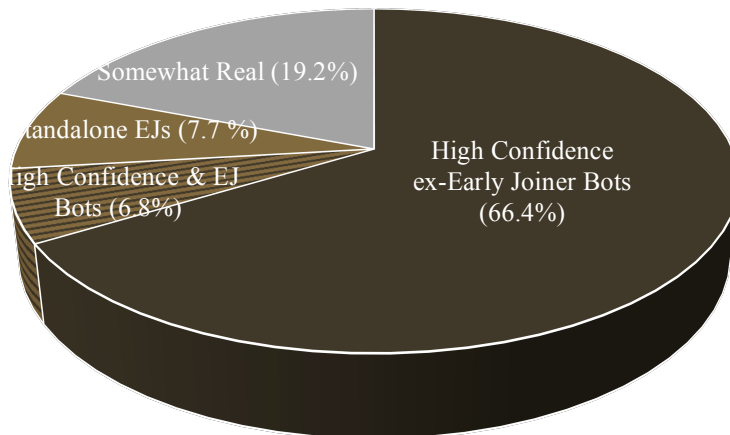
GSX Bot Behavior Mix



Including Early Joiners Brings the Bot Total to 80.8%

Totaling up the previous three categories, 73.2% are High Confidence bots. We think it is very likely that another 7.7% (4,143) are also bots, based on their “Early Joiner” behavior pattern.

Early Joiners + High Confidence Bots



Early Joiners are users who login to online classes implausibly early, and which we therefore believe are likely fake. We set the cut-off time at more than 30 minutes before class start, which we believe is company favorable. While in the real world, it would not be unusual to see some students in a lecture hall more than 30 minutes early, that is again not what we would expect real students to do in an online environment. It would be similar to logging into a video conference more than 30 minutes early. Yet, the Early Joiner is not an infrequent anomaly for GSX.

The total number of unique Early Joiners in our sample was 7,579 (14.0%), of which 3,676 (48.5%) exhibited at least one of the other assumed bot behaviors, which reinforces its value as an indicator of bots. Eliminating the duplicates from other categories results in Early Joiners of 3,903 (7.2%). Adding users that share Early Joiner IP addresses makes the total 4,143 Early Joiners (7.7%).

Had we decreased the cut-off time to more than 15 minutes before class, it would increase the number of Early Joiners by 1,962 (3.6%).

“Group Control” – Corroboration from a Former Manager

A former GSX manager corroborated our observations about the fake user patters. He displayed detailed knowledge of GSX’s bot operations, which he said began in 2015.

He said that GSX uses software nicknamed “Group Control” (群控软件) to control the bot networks. He stated that Group Control apparently can supposedly ramp up attendance through

trickles or bursts. This ability to control the bots' sign-on pattern shows that GSX is likely thinking about how to disguise its bot activity.

Group Control's back end apparently has tools to direct the flow of student attendance, such as by scheduling bot sign-ins, and determining the sign-in patterns (e.g., bursts, trickles). As is typical with bot farms, one or more servers are used to control over 500 to a 1,000 or more cell phones (IMEIs). Each device will have a separate cell phone number, WeChat number, and be programmed to buy a product, or attend a class, etc.

GSX also utilizes outside companies that operate bot networks. According to the former manager, these companies are typically compensated through a commission of about 2% to 5% of would-be revenue based on the tasks required. Some companies specialize in attending class. Some specialize in signing up for classes and paying. GSX apparently provides the cash needed to legitimize the transactions, and books much of the cost of generating these bot runs through sales and marketing expense or cost of sales lines. The former manager named three separate companies that reportedly provide bot users to GSX, including Weishi (an app owned by GSX) and Baijia Youlian (a 30% investee of GSX).

Below is a roughly two and one-half minute uninterrupted segment that offers some particularly interesting detail:

Former 跟学谁自己都有怎么一个机房，一个机房里面概有上万多的这样的机器，就是我们叫做群机器人，来自己去控制，一个人大概能控制一千多手机也没有问题，然后去远程也好，还是在机房也好，我可以控制所有的机器，然后去模拟真实的学生或者是真实的购物的数据, 这个已经很成熟的技术。

GSX itself has a room, in this computer room there are over 10,000 machines, we call them the group robots, which is used to control [the operation]. One person can control about 1,000 cell phones without a problem, and these can be operated remotely or from the room, I can control all of the machines. Then I can imitate the data generated by a real student or real buying, this is already a very mature technology.

Q GSX 他们自己有一个小的团队来操作吗？是这个意思吗？
GSX itself has a team that does this? Is that what you mean?

Former 对。一直都，一直都有存在个团队。
Yes. Always, this team has always been there.

Q 一直是从哪一个阶段来开始？是什么 17 年，这样，从新的一个模式？
“Always been there” means starting from when? Is it from 2017, beginning with the “new model”?

Former 不是，我们在二零，二零 15 年开始就有了。因为那时候我们做 O2O，我们给很多的机构引流，那时候学生特别少，我们要老师感觉来上课人不少，

特别刚开始的时候，我们已经有这样的技术，比如说只报了五个学生然剩下的 500 个我们就有机器人去，让流量很大，上网去听课，让他们感觉这个平台流量很大，从一五年开始就有。

No, this started in 20... in 2015 it already started. Because then we were doing O2O [online to offline], we helped many institutes attract more traffic.⁵ At that time there were few students, but we want the teachers to feel that there were many, especially when we just started, for example just five students might have signed up and the remaining 500 were robots, letting the traffic volume become very big, going online listening to the class, it let them feel that the platform's volume was huge. Starting from 2015 this was there.

Q 那这样学费是怎么做的呢？这个我有点不太了解，是给他们一个代码免费买课程吗？或者是这个小公司会怎么样付这个学费？

Then how was the tuition done? This I don't really understand, did they have a code to sign up for free? Or how would these small companies [bot operators] pay the tuition fees?

Former 比如说我是跟谁学，我会跟另外一家公司，比如[redacted]，我会跟它签，我要投一百万的广告，然后我会承诺给你，比如说，其中百分之 2，你可以自己留下来，比如说你可以留下两万块钱...

For example, I am GSX, I will use another company, like [redacted], and I will sign [a contract] with them, I will put Rmb 1,000,000 into ads, and they will promise me, for example, that 2%, that they can keep Rmb 20,000...

Q 两万快钱的佣金？

RMB 20,000 commission?

Former 对，两万快钱的佣金，这个两外 98 万你必须通过这些虚拟的手机号或微信的账号然后购买我的课程就变成我的收入，是这样子。这是一部分。这是跟谁学至少要亏本 2%对吧。这是一小部分。另外一个跟一些老师合作。。。就比如我同样给你一百万，然后我也会签成市场费用，把你的，那你必须把一百万卖回来，为什么这些小机构要怎么做呢？是因为你帮我你让我操作这个动作，你自己在平台上或微师开课的时候，我可以在在平台帮你免费做免费的推广，或给你一些广告位，然后或者一些平台上的推广，我可以给你，但你必须把一百万买回来，一般不会给他钱，是它，你自己投一百万买回来，然后在后面我在市场上广告补给你，或怎么样把钱还给你。是这样的模式。这个时候跟谁学不会亏钱。就把一百万转一下，我用广告位换你刷单的这个。

Right. RMB 20,000 commission. And the other RMB 980,000 they must use these virtual cell numbers or WeChat account numbers to purchase my classes, so that it becomes my revenues. It's like this. This is one part. In this way GSX will at least lose 2%, right? This is one small part. Another way is to work with

⁵ Prior to 2017, GSX's focus was on working with schools and teachers. See GSX F-1, pp. 12, 68, 82, F-18.

the teachers... for example, as before I provide RMB 1,000,000, and then contract with them [to exchange] for ads, and you must take that RMB 1,000,000 and return it to me as purchases. Why would they want to do that? It's because you help me do this thing, and when you yourself have a class on the platform or on Weishi (the App) we will help promote it for free, give free ads, or give you an ad placement, or on the platform run ads. This we can give you, but you must return the RMB 1,000,000 in the form of purchases. Normally they won't pay any money (like a commission). Its...you put in the RMB 1,000,000 and get it back as purchases, and then afterwards I provide ads in the marketplace for you, or otherwise provide you these funds. Its this kind of model. This way GSX does not lose money. It just takes the RMB 1,000,000 and round trips it; we use ad placements in exchange for this brushing [bots or fake student users].

Summary Methodology for Accessing the Data and Analyzing Student and Bot Activity

Analyzing Gaotu100.com and Genshuixue.com required two different approaches. We provide a more detailed description of the steps in Appendix 1.

The Genshuixue.com platform has both a website and a desktop application that students can use. Once a user signs up and logs in, the user opens Google Chrome Developer tools, turns on the Network tab, switches to XHR and sees data being passed between the browser and the Genshuixue.com website. Inside of this data there is a wealth of information including archives of every class session purchased, which is what we used to perform our analysis of bot activity on both platforms.⁶ There were no special tools or techniques required to perform this analysis.

Gaotu100.com is very similar in design and functionality with Genshuixue and shares domain names and resources with Genshuixue. After setting up an account and purchasing classes, it is possible to see some data flowing in the browser much like is the case with Genshuixue. However, Gaotu's data does not immediately show references to the class, so an additional step is required. If using an iPhone, it is necessary to install the Gaotu100.com app on the phone and configure the device to send data through an intercepting HTTP proxy. This method enabled our data analyst to watch the messages between the phone and the GSX servers, see what data was passed back and forth, and determine the path to the class archives. After locating the class archives, the files for each of our purchased classes were downloaded and examined.

We were surprised to see that not only were there class materials, but there were files that contained copious information about the users including:⁷

1. User Number
2. Name
3. Alternate Name
4. Avatar

⁶ The archives are in a zip file. The file format is GZIP-compressed TAR archive (.tar.gz) otherwise known as a tarball.

⁷ The data contained more than just this. This is a partial list of the most useful fields presented for the users.

5. User Type (0,1,2)
6. Course ID and/or Class ID (Gaotu only has Class ID's)
7. Class join and exit times
8. IP address

To conduct the analysis, our samples included over 200 paid K-12 classes purchased between January and March 2020, almost equally divided between Gaotu100.com and Genshuixue.com. The classes we obtained access to spanned K-12 grade levels and subject matter. In total, we analyzed 463,217 logins made by 54,065 unique users (students, tutors, and teachers). Gaotu was busier, accounting for approximately two-thirds of the logins.

Within the class data, we found User Numbers (that are also displayed in the class attendance records) but also User Types. By cross referencing the class data with data displayed in teacher and tutor pages on genshuixue.com, we found that 100% of the teachers listed on the genshuixue.com were marked as Type 1 users, and 100% of the tutors listed on genshuixue.com were marked Type 2 in our database.⁸ Identifying the Type was important to identifying GSX Linked Joiners. For a more in-depth explanation of this methodology, please see Appendix 2.

Our database of users, contains 29 Type 1's (teacher), 371 Type 2's (tutor), and 53,694 unique Type 0's.⁹ Since we determined that all Type 1 and 2 users were with GSX, we conclude that all remaining Type 0 records are the student users (non-teacher, non-tutors).

Distribution of GSX Users by Type				
User Type	Total Users	% of Total Users	Total Joins	% of Total Joins
Teachers Type 1	29	0.05%	300	0.06%
Tutors Type 2	371	0.69%	7,400	1.60%
Students Type 0	53,694	99.31%	455,517	98.34%

Chairman Chen's \$319 million Pledge:

On March 3, 2020, Chairman Chen pledged 6,000,000 Class B ordinary shares through his entity Ebetter International Group Ltd.¹⁰ These are equivalent to 9,000,000 ADSs with a market value of \$319 million.¹¹ Considering that GSX is a near total fraud, this pledge presents an even greater risk of sudden loss to GSX long holders. We do not preclude the possibility that he has pledged other shares.

The below is from the British Virgin Islands companies registry evidencing the pledge.

⁸ Gaotu100.com does not publish an up to date listing of teachers, only a poster-like yearbook style photo of some of their teachers. However, as all fields in our dataset between genshuixue.com and gaotu100.com are identical, we make the logical assumption that the Type field is identical between both platforms.

⁹ Among the teachers and tutors, the data showed 6 individuals as both a Type 1 and Type 2.

¹⁰ See <https://www.sec.gov/Archives/edgar/data/1768259/000119312520024745/d880275dsc13g.htm>

¹¹ GSX 2019 20-F, exhibit 2.5, Description of rights of each class of securities registered under Section 12 of the Securities Exchange Act of 1934 (the "Exchange Act"), pp.1,2, et alia.

Company Name
Ebetter International Group Limited (the "Company")

Company No.:	1835287
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R401

Description of document or instrument creating the charge or other security interest

A equitable share mortgage dated 30 March 2020 (the "Deed") between the Company as mortgagor and Credit Suisse AG, Cayman Islands Branch as mortgagee (the "Mortgagee") in connection with the margin loan agreement dated 30 March 2020 (as amended and supplemented from time to time, the "Loan Agreement"), by and among the Company as borrower, Larry Xiangdong Chen as guarantor, Credit Suisse AG, Cayman Islands Branch as original lender, Credit Suisse AG, Cayman Islands Branch as agent and Credit Suisse AG, Cayman Islands Branch as calculation agent.

Terms defined in the Deed and the Loan Agreement (whether defined therein or incorporated by reference to another document) shall, unless otherwise defined herein or unless the context otherwise requires, bear the same meanings when used herein. All references to any documents defined herein refer to the documents as amended, novated, supplemented, extended (however fundamentally and whether or not more onerously) or replaced and all references to any party defined herein shall be construed so as to include its successors in title, permitted assigns and permitted transferees.

Date on which the charge was created by the Company (and, if the charge is a charge existing on property acquired by the Company, the date on which the property was acquired)

30 March 2020

Short description of the liability secured by the charge

As a continuing security for the discharge and/or payment of the Secured Obligations.

"Secured Obligations" means all money, obligations or liabilities due, owing or incurred to the Mortgagee by any Obligor under any Finance Document at present or in the future, whether actual or contingent, whether incurred solely or jointly with any other person and whether as principal or surety, together with all interest accruing thereon and all losses incurred by the Mortgagee in connection therewith.

Short description of the property charged
--

The Company as legal and beneficial owner:

- (a) mortgaged in favour of the Mortgagee by way of a first equitable mortgage the Mortgaged Shares; and
- (b) charged in favour of the Mortgagee, by way of a first fixed charge, all of its right, title and interest in and to the Mortgaged Property including all benefits, present and future, actual and contingent accruing in respect of the Mortgaged Property (to the extent not effectively mortgaged under Clause 4.1 (a) of the Deed).

"Additional Collateral Shares" means the class B ordinary shares in GSX Techedu Inc. ("GSX") owned by the Company which are required from time to time to be subject to the Security created by the Deed pursuant to the terms of the Loan Agreement (including but not limited to clause 20 (Securities Collateral) of the Loan Agreement) and which are specified as such in each duly completed Top-Up Notice, accompanied by the documents referred to in Clause 4.7 of the Deed in form and substance satisfactory to the Mortgagee.

"Mortgaged Property" means the Mortgaged Shares and all rights, benefits and advantages at the date of the Deed or at

Company Name	
Ebetter International Group Limited (the "Company")	
Company No.:	1835287

<p>Short description of the property charged</p> <p>any time in the future deriving from or incidental to any of the Mortgaged Shares including:</p> <p>(a) all dividends or other distributions (whether in cash, securities or other property), interest and other income paid or payable in relation to any Mortgaged Shares;</p> <p>(b) all shares, securities, rights, monies or other property whether certificated or uncertificated accruing, offered or issued at any time by way of redemption, conversion, exchange, substitution, preference, option, bonus issue or otherwise in respect of any Mortgaged Shares (including but not limited to proceeds of sale);</p> <p>(c) all certificates or other evidence of title to any of the Mortgaged Shares at the date of the Deed and from time to time thereafter deposited with the Mortgagee; and</p> <p>(d) all other rights relating to any of the Mortgaged Shares which are deposited with or registered in the name of any depository, custodian, nominee, clearing house or system, investment manager, chargee or other similar person or their nominee, in each case whether or not on a fungible basis (including any rights against any such person).</p> <p>"Mortgaged Shares" means:</p> <p>(a) the class B ordinary shares owned by the Company in GSX as at the date of the Deed specified in Schedule 1 to the Deed, namely, the 8,000,000 Class B Ordinary Shares owned by the Company in GSX as represented by share certificate number B-003, (including, for the avoidance of doubt, the class B ordinary shares represented by any share certificate(s) issued in replacement of the share certificate(s) specified in Schedule 1 to the Deed);</p> <p>(b) all Additional Collateral Shares; and</p> <p>(c) any shares acquired in respect of Mortgaged Shares by reason of a stock split, stock dividend, reclassification, conversion or otherwise (including, for the avoidance of doubt, any (i) class A ordinary shares following automatic conversion of class B ordinary shares in GSX into class A ordinary shares in GSX in accordance with the memorandum and articles of association of GSX; (ii) American depositary shares of GSX following conversion of such class A ordinary shares in GSX into American depositary shares of GSX in accordance with the Foreclosure Documents and (iii) class A ordinary shares in GSX returned by the Depository (or its nominee) to the Company in the event any Mortgaged Shares are unable for any reason to be converted into American depositary shares,</p> <p>in each case, except to the extent that such shares have been released from the Security constituted by the Deed in accordance with Clause 12 of the Deed.</p>

<p>Name and address of the trustee for the security or, if there is no such trustee, the name and address of the chargee</p> <p>(Chargee) Credit Suisse AG, Cayman Islands Branch of 11 Madison Avenue, New York, NY 10010, United States</p>
--

<p>Unless the charge is a security to bearer, the name and address of the holder of the charge</p> <p>(Holder of the charge) Credit Suisse AG, Cayman Islands Branch of 11 Madison Avenue, New York, NY 10010, United States</p>

<p>Details of any prohibition or restriction, if any, contained in the instrument creating the charge on the power of the Company to create any future charge ranking in priority to or equally with the charge</p> <p>The Company covenanted that during the Security Period it will remain the legal and beneficial owner of the Mortgaged Property (subject to the security interests thereby created) and that it will not, except as permitted by the Finance Documents:</p> <p>(a) create or suffer the creation of any security interests (other than those created by the Deed or any other Transaction</p>
--

Appendix 1: Methodology for Analyzing Student and Bot Activity

Analyzing Gaotu100.com and Genshuixe.com required two different approaches, which we explain below.

Genshuixe.com

This platform has both a website and a desktop application that students can use. We did not analyze any mobile applications for this platform as it was not required. Once you have signed up with an account and have logged in you can simply open Google Chrome Developer tools, turn on the Network tab, switch to XHR and you can see data being passed between your browser and the Genshuixe.com website. Inside of this data there is a wealth of information including archives of every class session you have purchased which is what we used to perform our analysis of bot activity on both platforms.¹² There were no special tools or techniques required to perform this analysis.

To discover the archive, the following steps need to be completed from a Google Chrome Browser:

1. Login to your account.
2. Click on any of your courses that have classes that have already concluded.
3. Click on a class view button (See screenshot below), and then select the **playV2** item in the Chrome Developer Network view. Now look for **pcURL** value for each class in the course. Copy each of them.

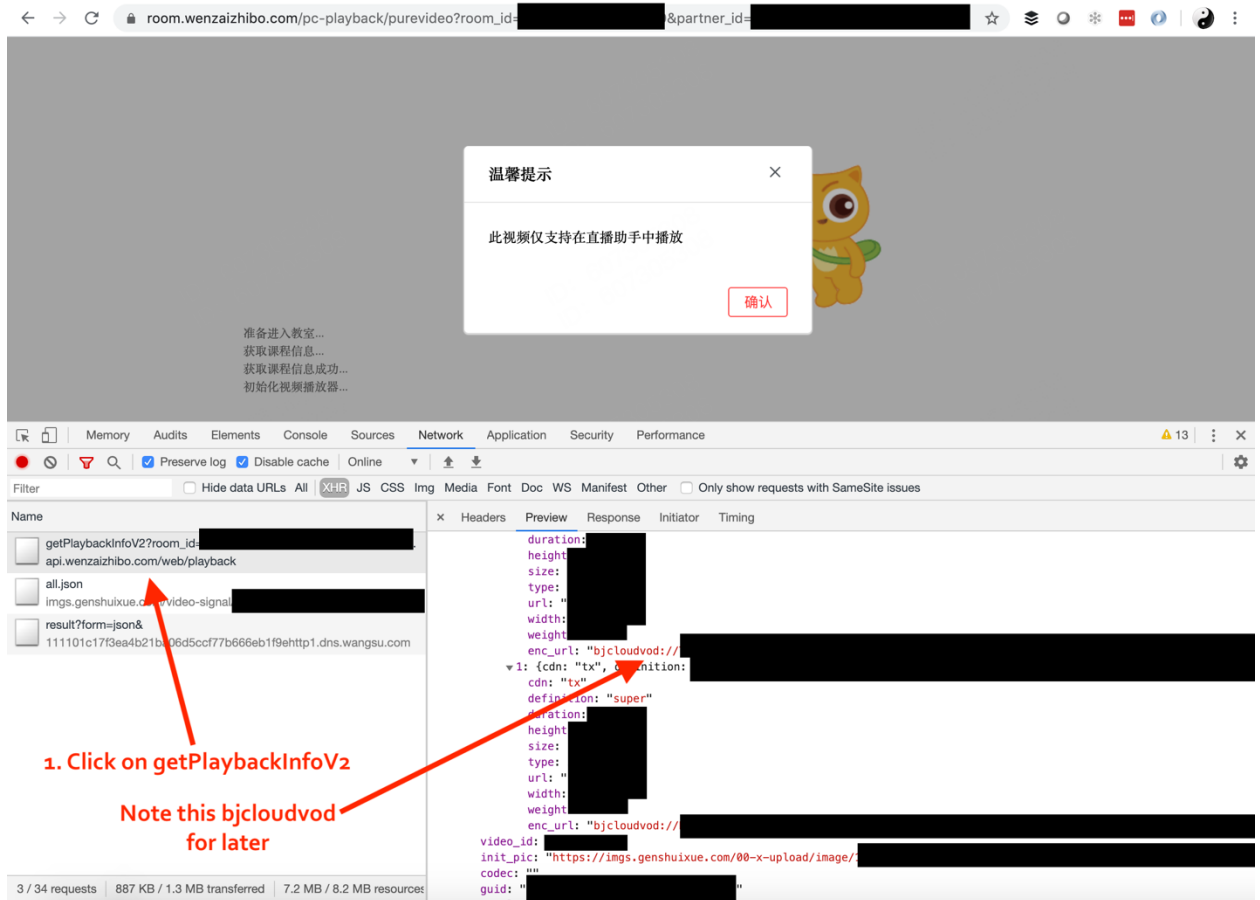
¹² The archives are in a zip file. The file format is GZIP-compressed TAR archive (.tar.gz) otherwise known as a tarball.

1. Click this button.

2. Click on playV2

3. Copy the pcUrl

4. Keeping Google Chrome Developer tools open, paste the first **pcURL** value that you copied, and browse to it. You will see activity in your Network tab of Google Developer Tools.
5. Click on the **getPlaybackInfoV2** item in the network view and view the data on the right hand panel.



- Continue to look through the data until you see a **package_signal** entry. This will now contain the URL for the archive file:

```

▼ package_signal: {, ...}
  package_url: "https://imgs.genshuixue.com/videoplaybackpackage/[redacted].tar.gz"
  package_size: [redacted]
  package_md5: "[redacted]"

```

- You can now download that zip file and use 7-zip on Windows or the native unzipping tools in Mac OSX to view the contents.

Gaotu100.com

Gaotu100.com is very similar in design and functionality of Genshuixue and shares a number of domain names and resources with Genshuixue. Once you have signed up for an account, and purchased classes, you are able to start seeing some of the data flowing in your browser much like on Genshuixue. However, there were no references to the class archives that we had seen on Genshuixue.com so further analysis was required.

We installed the Gaotu100.com app on an Apple iPhone and configured the iPhone to send data through an intercepting HTTP proxy. This allows us to watch the messages between our phone

and the GSX servers so we can see what data is being passed back and forth. This analysis yielded the path to the class archives that were the same as Genshuixue.

After discovering the class archives, we then downloaded the archive for each of our purchased classes, opened the file and examined the contents. We were surprised to see that not only were there class materials, but there were files that contained information about the students, when they joined, and other details.

Opening and inspecting the **all.json** file, gives us information about every student that joins, their user number, their IP address and a timestamp. There is also other information about when that student exits a class, as well as other information related to actions the instructor is taking.

The **all.json** file is also retrieved by your browser when you view a recorded session.

By having IP addresses, timestamps, and user identifiers, we were able to perform data analysis and bot detection across a number of classes on both Genshuixue and Gaotu100.

Appendix 2: Methodology for Differentiating Teachers & Tutors from Student in the Data

When examining the genshuixue.com website there is a listing of teachers and tutors on the following page:

<https://www.genshuixue.com/npc/teacherQualification>

Identifying Teachers by User Number

On Genshuixue.com each teacher has their own profile page that you can visit. This differs from gaotu100.com which only has a large image of all of their teachers on their platform. When clicking on a teacher's profile picture you are taken directly to their profile page.



Note that the number that is shown in the URL is the teacher's User Number. Each user on genshuixue.com and gaotu100.com have their own unique User Number.

← → ↻ genshuixue.com/pc/teacherDetail/813942178

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Identifying Tutors by User Number

Identifying tutors by their user number is slightly more difficult since tutors do not have their own profile pages. To find a tutor's user number we have to do the following:

1. Open Google Chrome Developer tools and browse to:
<https://www.genshuixue.com/npc/teacherQualification>
2. Click the Network tab.
3. Click the XHR tab (this shows data that your browser is requesting).
4. Filter on the word “assistant” (in English) and then refresh the page.
5. You will see a request going out to:
<https://www.genshuixue.com/sapi/viewLogic/teacher/assistantTeacherList?appType=6&cursor=0&size=30&hasMore=true&subject=5>
6. By examining the data in the Preview pane of the Network response, you can see there is data that provides us with the User Number (it is called Teacher Number in the screenshot below) for a tutor.

The screenshot displays a web browser window with the URL `genshuixue.com/npc/teacherQualification`. Two teacher profiles are shown side-by-side. The left profile is for 岳雨豪 (Yue Yuhao), a male teacher with a red shirt, identified as a '辅导老师' (Tutor) for '跟谁学·小学' (Genshuixue Primary). His teacher qualification number is 20184600731000001. The right profile is for 王彦沙 (Wang Yansha), a female teacher with a red shirt, also identified as a '辅导老师' (Tutor) for '跟谁学·小学' (Genshuixue Primary). Her teacher qualification number is 20184105532000919.

Below the profiles is a network inspector window. The 'Network' tab is active, showing a request to `assistantTeacherList?appType=6&cursor=0&size=30&hasMore=t...`. The response is a JSON object with the following structure:

```

{code: 0, msg: "请求成功", loggerId: "e8f19bc1-73de-46d7-a04d-a9a6c5efe093", ...}
code: 0
data: {items: [{teacherNumber: "330361798", teacherName: "岳雨豪", ...}, ...]}
items: [{teacherNumber: "330361798", teacherName: "岳雨豪", ...}, ...]
0: {teacherNumber: "330361798", teacherName: "岳雨豪", ...}
  avatar: "https://imgs.genshuixue.com/114226777_20vg9fku.jpeg"
  certificateNumber: "20184600731000001"
  certificateType: 1
  shortIntroduce: "跟谁学优秀数学辅导老师, 师范大学毕业本科生毕业, 中共党员, 具有"
  teacherName: "岳雨豪"
  teacherNumber: "330361798"

```

Here we can see the tutor's User Number (Teacher Number) is 330361798. We can then look up that number in our database class records.

Identifying All Teachers, Tutors and Students in Our Dataset

Once we have the User Number, we are able to do direct queries in our database of classes, to examine what classes they were involved in, and their join/leave patterns for those classes. When reviewing the teacher and tutor records from the website we noticed that there was a user "type" field that was present in both `genshuixue.com` and `gaotu100.com` records.

After examining a number of records manually and matching them up with the User Numbers identified for teachers and tutors, we found that the user type field tells us teachers are identified as "Type=1, tutors as "Type=2" and students as "Type=0." In our dataset of 29 teachers and 371 tutors, 100% of the teachers listed on the `genshuixue.com` were marked as Type 1 users and 100% of the tutors listed on `genshuixue.com` were marked Type 2 in our database. All remaining records were Type 0 which we conclude are the student users (non-teacher, non-tutors). `Gaotu100.com` does not publish an up to date listing of teachers, only a poster-like yearbook style photo of some of their teachers. However, as all fields in our dataset between `genshuixue.com` and `gaotu100.com` are identical, we assume that the Type field is identical between both platforms.

We then performed queries for each particular type of user (Type 0, 1 and 2), and then cross checked all users to see which matched up to the same IP addresses used by the Type 1 and Type 2, the known teachers and tutors. Below are examples of query results for a Type 1, Type 2, and Type 0.

Query results for a Type 1 teacher:

A	B	C	D	E	F	G
User_Number	Type	Group	Name	Actual_Name	IP_Address	Location
813942178	1	0	张镇老师	张镇老师	1.180.156.91	Tianjin,China
813942178	1	0	张镇老师	张镇老师	27.189.207.65	Beijing,China
813942178	1	0	张镇老师	张镇老师	183.155.219.165	Yiwu,China
813942178	1	0	张镇老师	张镇老师	115.211.148.97	China
813942178	1	0	张镇老师	张镇老师	183.155.218.214	Yiwu,China
813942178	1	0	张镇老师	张镇老师	36.25.23.40	Dongyang,China
813942178	1	0	张镇老师	张镇老师	125.112.136.88	Yiwu,China
813942178	1	0	张镇老师	张镇老师	183.155.217.18	Yiwu,China
813942178	1	0	张镇老师	张镇老师	114.221.73.180	Nanjing,China
813942178	1	0	张镇老师	张镇老师	125.112.136.111	Yiwu,China
813942178	1	0	张镇老师	张镇老师	106.120.214.142	Beijing,China
813942178	1	0	张镇老师	张镇老师	106.120.214.142	Beijing,China
813942178	1	0	张镇老师	张镇老师	106.120.214.142	Beijing,China
813942178	1	0	张镇老师	张镇老师	106.120.214.135	Beijing,China
813942178	1	0	张镇老师	张镇老师	106.120.214.135	Beijing,China
813942178	1	0	张镇老师	张镇老师	106.120.214.142	Beijing,China
813942178	1	0	张镇老师	张镇老师	106.120.214.142	Beijing,China
813942178	1	0	张镇老师	张镇老师	121.16.68.20	China
813942178	1	0	张镇老师	张镇老师	210.12.195.30	China
813942178	1	0	张镇老师	张镇老师	210.12.195.30	China

For the teacher above, we see their User Number is 813942178 and their name Teacher Zhang (张镇老师) matches that in their teacher account. In our data we also have an Avatar field (cut from above for formatting). This is the profile picture for an account. For the above user the Avatar URL is: https://imgs.genshuixue.com/176512378_yc9r2tpn.png

This matches the face and profile picture of the teacher shown on the Genshuixue.com teacher page.

Query Results for a Type 2 tutor:

A	B	C	D	E	F	G
User_Number	Type	Group	Name	Actual_Name	IP_Address	Location
330361798	2	1233545	B岳雨豪~小雨老师	B岳雨豪~小雨老师	106.120.214.158	Beijing,China
330361798	2	1233553	B岳雨豪~小雨老师		106.120.214.135	Beijing,China
330361798	2	1233544	B岳雨豪~小雨老师	B岳雨豪~小雨老师	210.12.97.30	China
330361798	2	1233544	B岳雨豪~小雨老师		210.12.195.30	China

For the tutor 330361798 above, the Type field set to 2. The name is Little Yu Teacher (B岳雨豪~小雨老师). The “B” appears to be indicative of their assignment to the Beijing office. The Avatar for this user is set to: https://imgs.genshuixue.com/114226777_z0vg9fku.jpeg

This matches the profile picture of the tutor on the Genshuixue.com website.

Verifying Type 0 users are Students:

We could not discover profiles for Students in the same way that Teachers have profiles. Instead, we turned to reviews that we collected from Genshuixue.com to assist in validating that a Type 0 user is a Student. We collected 948,158 reviews, and from those reviews we discovered 5,789 unique users making reviews in our user activity database that had written 29,245 reviews. Of these a total of 5,787 (99.9%) were student (Type 0) unique reviewers, with just 2 (0.03%) coming from teacher (Type 1) accounts. There were no reviews discovered that were written by a tutor (Type 2) account. We therefore are highly confident that a Type 0 user is a student.